Prediction of Flow in Non-prismatic Compound Open Channel using Artificial Neural Network

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Certificate

This is to certify that the work in the thesis entitled **Prediction of Flow in Non-prismatic Compound Open Channel using Artificial Neural Network** by **Devi Prasad Singh**, bearing Roll No. 711CE4012, is a record of an original research work carried out by him under my supervision and guidance in partial fulfilment of the requirements for the award of the Degree of ***Master of Technology (Dual Degree)*** **in** ***Civil Engineering***. Neither this thesis nor any part of it has been submitted for any degree or academic award elsewhere.

Dr. K.K. Khatua
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Abstract

Every stream on the planet is one of a kind. Some are tenderly bended, others are wind, and some others are generally straight and skewed. The extent of stream geometry additionally changes from segment to area longitudinally because of various pressure driven and surface conditions called non-prismatic channel. A significant part of the examination work are observed to be done on prismatic compound channels. There has additionally been an advancement of work found for winding channels. However, a time which has been dismissed is that of the work for non-prismatic compound channels. An exertion has been made to investigate the examination business related to non-prismatic directs in various sorts of stream conditions. A trial perception has been made to examine the speed appropriation, limit shear stress dispersion and vitality loss of a compound channel with merging surge plain. The computation of Depth normal speed, vitality misfortune, limit shear stress in non-prismatic compound channel stream is more perplexing. The expectation of the stream qualities in compound channels with prismatic and non-prismatic floodplains is a testing assignment for power through pressure engineers because of the three dimensional nature of the stream. Basic traditional methodologies can't foresee the aforementioned stream attributes with adequate precision, subsequently here an effortlessly implementable system the Artificial Neural Network can be utilized for forecast, approval and investigation of the stream parameters specified. The model performed entirely agreeable when contrasted and the other traditional strategies.

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Wij Weight factor which represents interconnection of ith node of the first layer to the jth node of t he second layer

f Sigmoidal transfer function

W_{kj} Weight factor which represents interconnection of k^th node of the first layer to the j^th node of the second layer

Ep Mean squared error for a pattern

□W(t) Weight changes at any time t

n Learning rate

□ Momentum coefficient

α Width ratio

σ Aspect ratio

θ Angle of convergence of divergence

S Slope of the channel

B Channel cross section width

b Width of the main channel

h Main channel width

s Main channel side slopes

D_r Relative Depth

β Depth ratio

Xr The distance of the point velocity in the width wise of the cross section / total width of the cr oss section taken into consideration.

Yr Distance of point velocity depth wise of the cross section / total depth of the cross section take n into account.

Z_r Point velocity in the length wise direction of the channel)/total length of the non-prismatic channel.

z1 & z2 Bottom elevation above a given datum at section 1 and 2 respectively.

y1 & y2 the flow depths at section 1 and 2

v1 & v2 Mean velocities at section 1 and 2 respectively

h1 Local energy loss due to channel contraction

α1 & α2	Velocity head correction factors at section 1 and 2
E1 & E2	Energy at section 1 and section 2
□P	Pressure difference
□*o*	Boundary shear stress
d	Outer diameter of the tube
ρ	Density of the flow
v	Kinematic viscosity of the fluid
□*h*	Difference between the two readings of pitot tube, static and dynamic heads
MSE	Mean squared error
RMSE	Root Mean squared error
MAE	Mean absolute error
MAPE	Mean absolute percentage error
ANN	Artificial Neural Network

Chapter 1

INTRODUCTION

1.1 Overview

Water is maybe the most central and essential asset accessible to humankind. It touches base ashore as precipitation and comes back to the ocean by method for stream channels. Generally, waterway chann els enough pass on the water back to the ocean yet once in a while, under states of high precipitation and expansive stream rates, the stream channel may overtop its banks and stream onto the surge plain with conceivable risk to life and property. Waterways are a characteristic part of our scene and structu re an indispensable part of the water cycle. As a matter of course waterways are the impact of Grandn ess and the notable pith of a settlement. Additionally streams give peace and Serenity to mankind. Indi viduals have lived close waterways for a considerable length of time because of the reason of principal ly sustenance, water, transport and assurance. In any case, here and there, it might bring about genuine harm to individuals and the spots in which they live regardless of the fact that it is a little, moderate streaming stream or tender waterway. Compound directs have been utilized in stream building for a lo ng time in view of their significance in natural, biological, and plan issues identified with surge protect ion plans. One favorable position of two phase directs in the regular waterway, by and large a fundam ental stream channel and its floodplain, is to build the channel movement amid surges. It is critical to comprehend the stream attributes of waterways in both their inbank and overbank stream conditions.At the point when the stream is outbank, ordinarily amid a surge, there is a huge increment in the manysi ded quality of stream conduct, notwithstanding for moderately straight reaches. The distinction in speed between the fundamental channel and the floodplain streams may deliver solid parallel shear layers, wh ich prompt the era of expansive scale turbulent structures, normallysubstantialstage vortices,as appeared by Sellin (1964), Ikeda et al. (1994 and 2001), Ikeda (1999) and Bousmar (2002).

1. Prismatic Open Channels
2. Non prismatic Open Channels

The open direct fit as a fiddle, size of cross segment and slant of the
bed stay consistent are said to be as the prismatic channels else it is non prismatic channe Regular

channels are a case of the non-prismatic channels andrrrartificial open channels are the case of prismatic channels. A few case of non
prismatic channels are course through ducts , move through extension docks and obstacles, channel intersection and so on. Investigation of nonprismatic stream, circulation of stream and speed assume a noteworthy part in connection to commonsense issues, for example, surge insurance, surge plain admini stration, bank security, route, water admissions and silt transport-depositional designs.

The multifaceted nature of the issue rises progressively when managing a compound channel with nonp rismatic floodplains. In non prismatic compound channels with uniting floodplains, because of progress in floodplain geometry water streaming on the floodplain now traverses water streaming in the fundam ental channel, bringing about expanded connection and energy trades. This additional energy trade ough t to likewise be considered in the stream demonstrating. It is understood that when the stream is outba nk the release limit of a compound channel is influenced by the energy trade between the primary cha nnel and its related floodplains. The energy exchange over the primary channel/floodplain interface dim inishes the transport limit of the fundamental channel and expands the release limit of the floodplain, e specially at low relative profundities, what's more, thusly lessens the aggregate movement limit of the whole channel cross area.

Trial offices, instrumentation and PC models have been step by step enhanced on the planet. Truth be told, for the last 2 or 3 decades, improvement of new speed measuring gadgets, information accumulati on frameworks and numerical models has made conceivable significant advances in knowledge.

The fundamental goal of the profundity normal speed estimations was to explore the extent of stream i n principle channel and on the floodplains at various positions along the flume. The speed appropriatio ns were additionally used to research the power and vitality parities in compound channels with non-prismatic floodplains.

Utilizing a pointer gage, which was situated on an instrument carriage, the longitudinal water profiles h ave been recorded. The aggregate vitality head was assessed by adding the dynamic vitality head to th e water surface profile level. The limit shear stress dissemination is another essential parameter in strea m demonstrating. It is required when concentrating on power equalizations, or while adjusting a numeri cal model, which usually requires learning of the variety of neighbourhood resistance coefficients. To a ssess the limit shear stress appropriation around the wetted edge, and the shear powers for every relati ve profundity, limit shear stress estimations were performed at chose cross-areas.

1.2 ARTIFICAL NEURAL NETWORK

ANN is another and quickly developing computational method. As of late it has been comprehensively utilized as a part of pressure driven designing and water assets. It is an exceedingly self-sorted out, self-adjusted and self trainable approximator with high cooperative memory and nonlinear mapping. ANNs can be seen to be a rearranged model of human sensory system, it can reproduce intricate and nonlinear issues by utilizi ng an alternate number of nonlinear preparing components i.e. The hubs or neurons. The hubs are asso ciated by connections or weights. ANNs may comprises of numerous layers of hubs interconnected wit h different hubs in the same or distinctive layers. Different layers are alluded to as the information lay er, the shrouded layer and the yield layer. The inputs and the bury associated weights are prepared by a weight summation capacity to deliver a whole that is gone to an exchange capacity The yield of the exchange capacity is the yield of the hub.

In this examination work multilayer observation system is utilized. Info layer gets data from the outer source and passes this data to the system for preparing. Concealed layer gets data from the information layer and does all the data preparing, and yield layer gets handled data from the system and sends th e outcomes out to an outside receptor. The info signs are altered by interconnection weight, known as weight component wij which speaks to the interconnection of ith hub of the principal layer to the jth hub of the second layer. The aggregate of adjusted signs (absolute initiation) is then altered by a sigm oidal exchange capacity (f). Also yield signs of concealed layer are adjusted by interconnection weight (Wij) of kth hub of yield layer to the jth hub of the shrouded layer. The entirety changed k sign is t hen adjusted by an immaculate direct exchange capacity (f) and yield is gathered at yield layer.

Let Ip = (I_{p1}, I_{p2},…,I_{pl}), p=1,2,…,N be the pth pattern among N input patterns.W_{ji} and W_{kj} are c onnection weights between ith input neuron to jth hidden neuron and jth hidden neuron to kth outp ut neuron respectively.

Output from a neuron in the input layer is

Opi=Ipi, i=1,2,…,l

Output from a neuron in the hidden layer is

$$Opj = f\,(NETpj) = f(\textstyle\sum_{i=0}^{l} Wji\ Opi),\ j = 1,2,\ldots,m \quad (2)$$

Output from a neuron in the hidden layer is

$$Opk = f\,(NET\ pk) = f\,(\textstyle\sum_{i=0}^{l} Wkj\ Opj\,),\ k=1,2,\ldots,n \quad (3)$$

1.2.1 Sigmoidal Function

A bounded, monotonic, non-
decreasing, S Shaped function provides a graded nonlinear response. It includes the logistic sigmoid function

$$F(x) = \frac{1}{1+e^{-x}} \quad (4)$$

Where x =inputparameters taken

1.2.2 Learning or preparing in back engendering neural systems

Group mode sort of managed learning has been utilized as a part of the present case in which intercon nection weights are balanced utilizing delta guideline calculation in the wake of sending the whole pre paring test to the system. Amid preparing the anticipated yield is contrasted and the craved yield and t he mean square blunder is ascertained.

On the off chance that the mean square mistake is all the more, then an endorsed restricting worth, It is back engendered from yield to info and weights are further adjusted till the blunder or number of c ycle is inside a recommended limit.

Mean Squared Error, Ep for pattern is defined as

$$Ep = \sum_{i=2}^{n} \frac{1}{2} (Dpi - Opi)^2 \quad (5)$$

Where Dpi is the target output, Opi is the computed output for the ith pattern.

Weight changes at any time t, is given by

$$\Delta W(t) = -nEp(t) + \alpha \times \Delta W(t-1)$$

(6) n = learning rate i.e.

$0 < n < 1$

α = momentum coefficient i.e. $0 < \alpha < 1$

1.3 DEPTH AVERAGE VELOCITY DISTRIBUTION:

It is entirely hard to model streams in non prismatic merging compound channel as the width differs f rom area to segment all through the channel. Profundity found the middle value of speed means the n ormal speed for a profundity "h" and is expected to happen at a stature of 0.4h from the bed level. T he information of speed dissemination knows the speed size at every point over the stream crosssegme nt. It is additionally key in numerous pressure driven designing studies including bank security, dregs t ransport, movement, water admissions and geomorphologic examination Compound channels are the dis tance distinctive and speed dispersion is a blend of surge plain and principle channel (Prismatic or No n prismatic).

In laminar stream max stream astute speed happens at water level; for turbulent streams, it happens at around 5-
25% of water profundity beneath the water surface (Chow, 1959). Ordinary stream astute speed sha pe lines (isovels) for stream in different cross areas are appeared in Fig. 1.1.

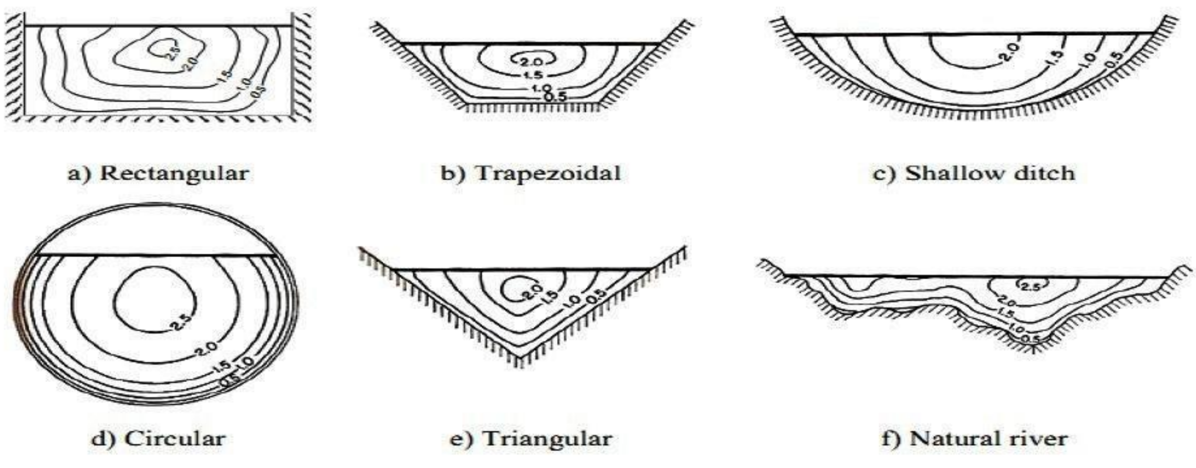


Figure 1.1 Typical stream wise velocity contour lines (isovels) for flow in various cross section s

1.3.1 Logarithmic law

The "logarithmic law" definition for the speed profile in turbulent open channel stream depends on Prandtl's (1926) hypothesis of the "law of the divider" and the "limit layer" idea. The limit layer i s a dainty locale of liquid close to a strong surface (bed or divider) where the limit resistance and the gooey communications influence the smooth movement and therefore, the speed propriation. In the completely created stream locale, this layer incorporates two primary sublayers.N ear the strong limit, a thick sublayer (laminar layer) shapes where the gooey power is prevalent. C onversely, assist far from the limit, the turbulent shear stresses assume a noteworthy part in the im perfection layer (turbulent layer).The "law of the divider" expresses that the in the stream insightful bearing, the normal liquid speed in the limit layer changes logarithmically with separation from th e divider surface.

1.4 ENERGY AND ENERGY LOSS IN NON-PRISMATIC COMPOUND CHANNEL:

Dissemination of vitality in a compound channel is an imperative perspective. So it should be tend ed to legitimately. It is seen that, the waterway by and large display a two phase geometry (more profound principle channel and shallow floodplain called compound area) having either prismatic or non-prismatic (geometry changes longitudinally). Because of stream connection between the fundamental channel and surge plain the stream in a compound area devours more vitality than a channel with basic segment conveying the same stream and having the same sort of channel surface. Again in focalizing channel some more parameters are impacted, for example, width constrictions. Because o f the quickly developing populace, and to the resulting interest for sustenance and convenience, mo re land close to stream territories has been utilized for horticulture and settlement making the chan nel cross segment uniting. A despicable estimation of surges, will prompt an expansion in the deat h toll, and properties. The displaying of such streams is of essential significance when trying to dis tinguish overwhelmed regions and for surge hazard administration examines and so forth.

Again routine methodologies which depend on exact strategies need in giving high precision to the expectation of the vitality misfortunes. That is the reason another and precise methods are excepti onally requested. This study acquaints an effective methodology with assessment the vitality misfort unes with the assistance of counterfeit neural system which is a promising computational device in structural building.

1.5 BOUNDARY SHEAR STRESS IN NON-PRISMATIC COMPOUND CHANNEL:

Exact estimation of limit shear power appropriation is key to manage different water driven issues, for example, channel plan, channel relocation and connection misfortunes. Bed shear strengths are helpful for the investigation of bed burden exchange where as divider shear powers shows a genera l perspective of channel movement design. the investigation of nonprismatic compound channels un der various geometric and water powered condition are important to comprehend one of the stream properties, for example, conveyance of limit shear which is a superior pointer of auxiliary streams than speed, on various parameters like viewpoint proportion, sinuosity, proportion of least span of ebb and flow to width and pressure driven parameter, for example, relative profundity. With the r eason for acquiring shear stress appropriation at the dividers and on the bed of compound non-prismatic channel, exploratory information gathered from research center under various release and relative profundities keeping up the geometry, incline and sinuosity of the channel steady, are disse cted and stood up to. Prestontube procedure is utilized to gather speed heads at different interims a long the wetted edge and inside the stream that figures shear stress values utilizing alignment bend s proposed by Patel (1965).

At the point when water streams in a divert the power created in the stream course is opposed by res ponse from channel quaint little inn dividers. This resistive power is showed as limit shear power. Gen erally expressed, tractive power, or limit shear anxiety, is the tangential segment of the hydrodynamic strengths acting along the channel bed. Circulation of limit shear power along the wetted border specifi cally influences the stream structure in an open channel. Learning on limit shear stress dispersion is im portant to characterize speed profile and liquid field. Additionally calculation of bed structure resistance , silt transport, side divider revision, cavitations, channel relocation, movement estimation, and scatterin g are among the pressure driven issues which can be settled by bearing the possibility of limit shear st ress dispersion. Different components that influence the appropriation of shear anxiety in straight non-

primatic compound channel are state of the cross-
segment, number and structure of auxiliary stream cells, profundity of stream, residue fixation and the horizontal longitudinal conveyance of divider harshness. Amid surge when waterways are at high stage, the stream from the fundamental channel spills and spreads to the contiguous floodplain. The decrease d water driven range and higher harshness of floodplain result in lower speeds in floodplain when cont rasted with the principle channel.

The association between the speedier moving liquid in fundamental divert and slower liquid in floo dplain result in a bank of vortices as appeared by Knight and Hamed (1984), alluded to as "turbul ence marvel". Thus there is a horizontal exchange of force that outcomes in a clear shear stress at the interface of fundamental channel and floodplain which altogether contort stream and limit shea r stress designs. The complicated system of force move in a straight two phase divert is shown in Fig.1.2.

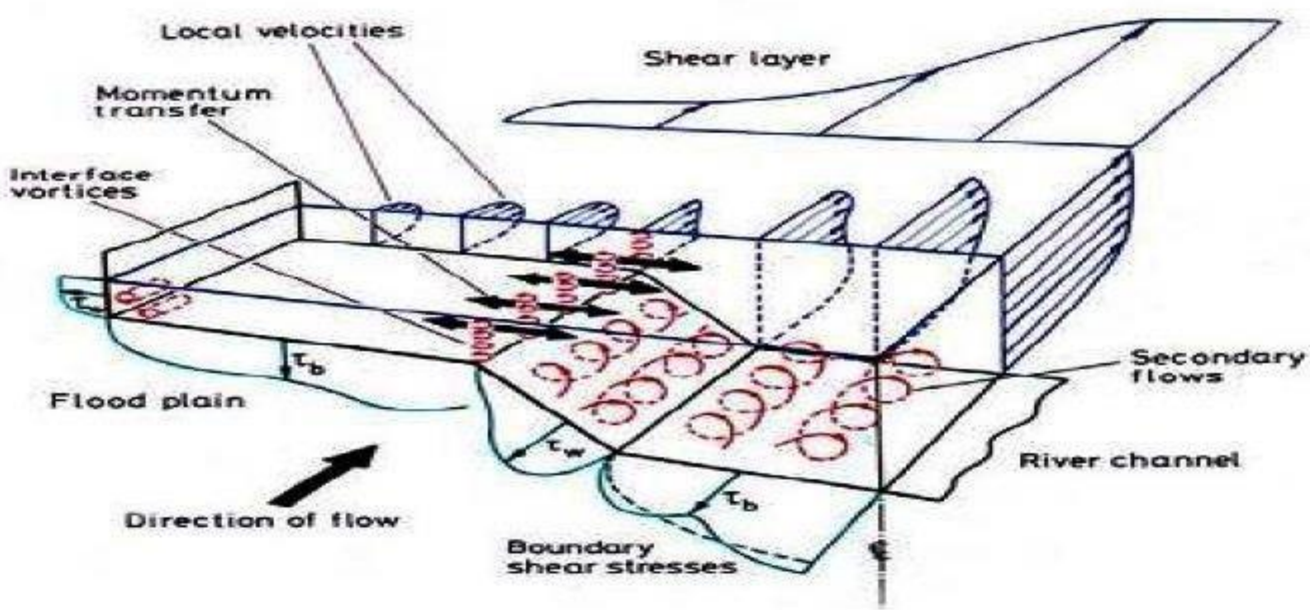


Fig.1.3 3D flow structures in open channel

1.6 OBJECTIVE OF PRESENT RESEARCH WORK:

The general point of this exploration is to enhance the floodplain power through pressure in compo und channels with non-prismatic floodplains. In this exploration an endeavor will be made to contemplate the forecast of Depth normal speed, the measure of vitality put away in a test segment and the measure of vitality lost all through the areas of a nonprismatic compound channel and the Boundary Shear stress pro duced all through the segments of a non-prismatic compound channel utilizing an Adaptive Artificial Neural Network technique.

Examination will be made between the old customary techniques and the new and informed Adaptive s trategy with respect to Artificial Neral Networks to see which strategy is more exact and precise and g ives quicker and brighter results.

The accompanying particular parts of stream surge power through pressure will be explored for non-prismatic straight compound channels with overbank stream:

I.To study the circulation of stream insightful profundity found the middle value of speed for a sol itary stream profundity, likewise to study its variety at various stream profundities for overbank stream conditions.

II. Determination of the measure of vitality put away all through the areas of a non-prismatic compound channel furthermore the measure of vitality lost all through the trial segments of a non-prismatic compound channel.

III.To complete an examination concerning the circulation of nearby shear stress in the primary cha nnel and surge plain of non-prismatic compound channel.

IV.Determination of limit shear stress appropriation along the wetted border in nonprismatic compo und channels.

V.To conduct test and dissect exploratory information for the examination of longitudinal divider a nd bed shear stress for various stream profundities for compound non-prismatic open channels.

VI.To devise a versatile technique particularly Artificial Nerual Network strategy to anticipate, acce pt and analyze the consequences of the study subjects with the old traditional strategies.

VII.Comparison of the outcomes acquired with the traditional strategies and investigation of the exa ctness and precision of the general exploration work.

1.7 ORGANIZATION OF THESIS:

In this theory an endeavor has been made to foresee stream parameters of a nonprismatic compound channel utilizing a versatile framework particularly the Artificial Neural Network. An expectation of Depth normal speed, Energy put away and lost all through the trial channels and the Boundary Shear Stress made all through the trial segments of the channel has been done utilizing the ANN strategy. A correlation has been done between the genuine results acquired and the anticipated results got and the precision of the ANN method has been affirmed. In this postulation the association is as underneath

Chapter one is about Introductions. As a matter of first importance the Artificial Neural Network has been presented and the advances and the significance has been talked about. A slight comprehension on what really the Depth normal speed, Energy misfortune and Boundary shear stress study significance is and how they affect the marvels. In this part the Objective of the entire examination study and the present proposal has additionally been said.

Chapter two is about the Literature audit and the past studies that have been performed on the Artificial Neural Networks. Thinks about led on nonprismatic compound channels and the endeavors to discover the speed disseminations, Energy and vitality misfortune concentrates on and the Boundary shear stress considers have been examined with the name of the analysts and the year of study fulfillment has been specified quickly and sequentially.

Chapter three examines the Experimentation and Methodology of the momentum research work with the itemized depiction of the experimentation procedure and the structure of the examination channel and all the contraption and supplies utilized all through the exploration work. Estimations of the profundity normal speed, the wellspring of information determination, choice of pressure driven geometry and surface parameters have been said. The examination of vitality misfortune and affecting parameters have been talked about and which elements are thought about in the choice of water driven parameters for the study are specified. The estimations of Boundary shear stress have additionally been talked about in this section. The estimation of the bed incline of the channel is likewise of the worries in this part.

Chapter four is about the Experimental Results that have been found subsequent to performing the experimentations and investigation. All the charts of the connections and the lingering investigation are appeared in the section in its individual study bits. The factual aftereffects of the blunder estimations are available to demonstrate the precision of the present exploration work .Chapter five a gathering of the conclusions found from the consequences of the flow research work.

Chapter 2

LITERATURE REVIEW

2.1 OVERVIEW

A try has been made in this part to join distinctive parts of past investigation in water driven planning concerning the behavior of streams and channels in the midst of overbank stream. Until the mid Sixties, little was known of the psyche boggling stream outlines which exist between a channel and its surge fields, yet late upgrades have incited a clearer appreciation of the water fueled segments required, in any occasion at the level of model studies. A vital step in getting a better appreciation of conduit systems is than study its rate dispersal with most great precision. The stream gauge of conduit streams is basic information for floodcontrol channel plot, channel alteration and recovery endeavors and it impacts the vehicle of defilements and deposit.

There are confined studies open in composing concerning the stream in non-colorful compound channel and the parameters affecting the stream especially the Depth typical pace, the Energy Loss all through the channel and the Boundary shear stress made.

Studies are required to be driven on these edges as these are the outright aggregate of the water characteristics in a non-vivid compound channel and are particularly key for water engineers.

The written work review contains a broad gathering of examination on the subjects of Depth ordinary pace, Energy and Energy Loss, Boundary Shear stress and dominatingly on the past investigation works that have used Artificial neural framework as their key and flexible technique for examination and desires finished in open channel streams. This study hopes to display a segment of the picked gigantic duty to the examination of the said viewpoints from before times to the most recent ones open.

SARAT KUMAR DAS, PRABIR KUMAR BASUDHAR (2008) This paper demonstrates a neural framework model to envision the staying grinding point considering earth part and Atterberg's cutoff focuses. Highlight is determined to theconstruction of neural illustration outline, in light of the weights of the made neural framework model, to find quick or in reverse effect of soil properties on the remaining shear point. An estimate model condition is set up with the weights of the neural framework as the model parameters.A. BILGIL, H. ALTUN (2008) Investigated the stream resistance in smooth open channels using Simulated Neural Networks. The assessed estimations of rubbing coefficient is used as a piece of Manning's Equation to envision the open redirect streams in order to do a connection between's the proposed neural frameworks based philosophy and the standard ones.

CHAPTER 3

EXPERIMENTATION AND METHODOLOGYcc

3.1 OVERVIEW

Typically trial work ought to be directed on regular streams for nonprismatic compound channels, but since of the tedious procedure and the way that common streams are hard to have entry to in our late locational condition, we have limited our work to just lab work and lab displaying for the nonprismat ic compound divert in which we have performed our tests and have recorded the readings for the inve stigation of various stream parameters, so all our examination work has been confined to research facil ity demonstrating and the manufactured channel worked inside the lab showing the genuine part of non -prismatic compound channels.

Tests have been directed on the nonprismatic compound divert situated in the Hydraulics research facili ty of National Institute of Rourkela for examination and investigation of various parameters impacting stream in nonprismatic compound channel particularly Depth normal speed, Energy put away and Ener gy lost all through the test areas of the channel lastly the Boundary Shear Stress created in each test s egment of the channel mulled over.

Other than the way that National Institute of Technology Rourkela had constrained assets and restricted exploratory offices, still the study was done very tasteful and was finished with the direction of exper ienced and dedicated educators of water assets particularly Dr. K. K. Khatua and other persevering staf f of Water Resources specialization

3.2 DESIGN AND CONSTRUCTION OF CHANNEL

Tests have been directed in two arrangements of nonprismatic compound channels with shifting cross a rea worked inside a solid flume measuring 15m long ×.90m width × 0.55m profundity and flume with perpexsheet of same measurements. The width proportion of the channel is α=1.8 and the viewpoint p roportion is σ=5 where width proportion is the proportion between width of floodplain to width of prin ciple channel and perspective proportion is the proportion between width of channel to profundity of st ream. The joining point of the channels are taken as 12.38° and 50 (Naik 2014).Converging length o f the channel is observed to be

0.84m and 2.28m.We had additionally assembled information from the compound channels with non-prismatic floodplains meeting from 400mm to 0mm along 2m and 6m lengths, and narrowing from 40 0mm to 200mm along a 6m length (Rezai 2006) (comparing meeting edges of 8=11.31, 8=3.81, and 8 =1.91 degrees separately),

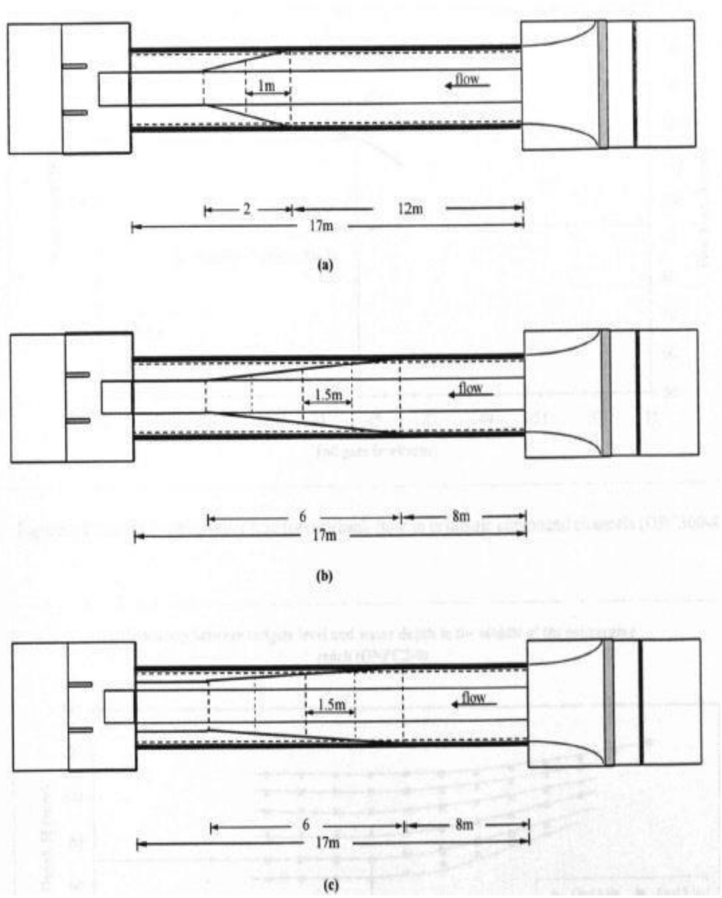


Fig.3.1 Plan view of compound channels with non-prismatic floodplains; (a) converging from 400 to 0mm along a 2m length (ONPC2-0); (b) narrowing from 400mm to 0 mm along a 6m length (ONPC6-0) and; c)converging from 400mm to 200mm along a 6m length (ONPC6-200)

Water was supplied through a Centrifugal pumps (a 15 hp) releasing into a RCC overhead tank. In the downstream end there falsehoods a measuring tank took after by a sump which encourage the water t o the overhead tank through pumping. This courses of action finishes the distribution arrangement of w ater for the trial channels. (Fig.2a,) demonstrates the outline of measurements of channel with test area respectively.2 (b) demonstrates the run of the mill matrix demonstrating the course of action of speed estimation focuses along flat and vertical heading at the test segment. Water was supplied to the flum e from an underground sump by means of an overhead tank by radiating pump (15 hp) and recycled t o the sump in the wake of coursing through the compound channel and a downstream volumetric tank fitted with conclusion valves for adjustment reason. Water entered the channel ringer mouth segment by means of an upstream rectangular score particularly worked to quantify release in the research cente r channel. A customizable vertical entryway alongside stream straighteners was given in upstream segm ent adequately in front of rectangular score to decrease turbulence and speed of methodology in the str eam close to the indent area. At the downstream end another movable rear end was given to control t he stream profundity and keep up a uniform stream in the channel. A mobile scaffold was given over the flume to both traverse savvy and stream insightful developments over the channel territory so that every area on the arrangement of compound meeting channel could be gotten to for taking estimations.

Fig.3.2 Top views of the experimental channel located in the hydraulics laboratory of NIT Ro urkela

Table 3.1 Hydraulic parameters for the experimental channel data set collected from literature & experiments

Verified test channel	Types of channel	Angle of convergent/Divergent	Longitudinal slope (S)	Cross sectional geometry	Total channel width (B) in m	Main channel width (b) in m	Main channel depth (h) in m	Main channel side slope (s)	Width ratio B/b (□)
1	2	3	4	5	7	8	9	10	11
Rezai(2006)	Convergent (CV 2)	(Ɵ=11.31°,2 m)	0.002	Rectangular	1.2	0.398	0.05	0	3
Rezai(2006))	Convergent (CV 6)	(Ɵ=3.81°,6m)	0.002	Rectangular	1.2	0.398	0.05	0	3
Rezai(2006)	Convergent (CV 6)	(Ɵ=1.91°,6m)	0.002	Rectangular	1.2	0.398	0.05	0	3
N.I.T.Rkl data	Convergent	(Ɵ=5°,2.28m)	0.0011	Rectangular	0.9	0.5	0.1	0	1.8
N.I.T.Rkl data	Convergent	(Ɵ=12.38°, 0.84 m	0.0017	Rectangular	0.9	0.5	0.1	0	1.8

3.3 APPARATUS and EQUIPMENTS USED:

Water surface estimations were measured specifically with point gage situated on an instrument carriag e, which could be moved along the flume. A vertical manometer was utilized to quantify the static and element weight. Preston tube was used for the estimation of point speed in every last recording mulle d over which performed very acceptable for the ebb and flow research work.

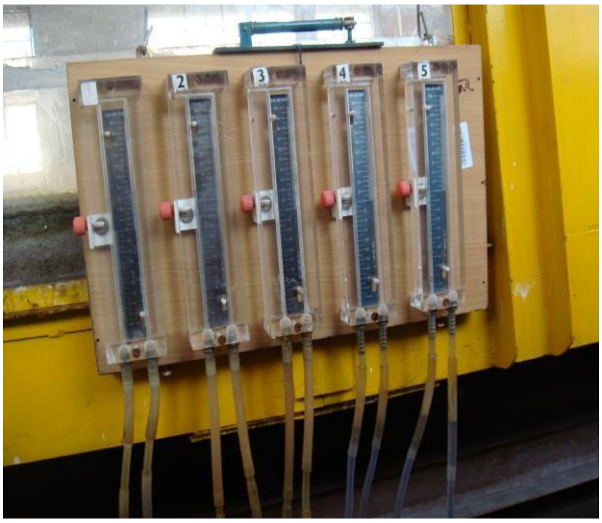


Fig.3.3 Series of Manometers

Fig.3.4 Taill Gate

Fig.3.5 Non prismatic section of the channel

Fig.3.6 Arrangements of the channel

3.4 EXPERIMENTAL PROCEDURE

The estimations were made each 5mm and 10mm in focalizing flume of .840 m and 2.28m length. Poi nt speeds were measured along verticals spread over the fundamental channel and surge plain in order to cover the width of whole cross segment. Additionally at a no. of flat layers in every vertical, point speeds were measured. Estimations were along these lines taken from midpurpose of principle channel to one side edge of floodplain. The sidelong separating of network focuses over which estimations wer e taken was kept 5cm inside the fundamental channel and the surge plain. Speed estimations were take n by Pitot static tube (outside distance across 4.77mm) and two piezometers fitted inside a straightforw ard fiber square altered to a wooden board and hung vertically at the edge of flume the closures of w hich were interested in environment toward one side and associated with aggregate weight opening and static gap of Pitot tube by long straightforward PVC tubes at different finishes. Before taking the read ings the Pitot tube alongside the long tubes measuring around 5m were to be legitimately inundated in water and alert was practiced for complete removal of any air bubble present inside the Pitot tube or the PVC tube. Indeed, even the nearness of a little air rise inside the static appendage or aggregate we ight appendage could give incorrect readings in piezometers utilized for recording the weight. The edge of appendage of Pitot tube with longitudinal course of the channel was noted by roundabout scale and pointer plan connected to the stream heading meter. Pitot tube was physically turned concerning the st andard course till it recorded the most extreme redirection of the manometer perusing. A stream headin g discoverer was utilized to get the course of most extreme speed as for the longitudinal stream bearin g. Relentless uniform release was kept up the keep running of the trial and a few runs were led for o verbank stream with relative profundity shifting between 0.15-0.51.

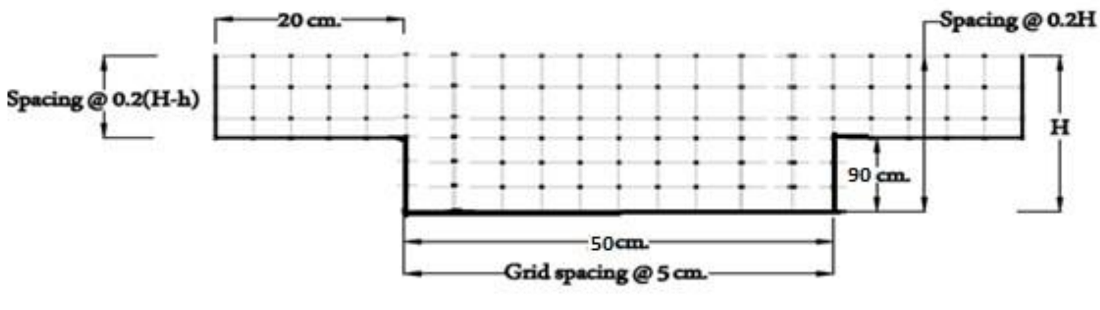


Fig.3.7 Typical grid showing the arrangement of velocity measurement points along horizontal and vertical direction at the test section.

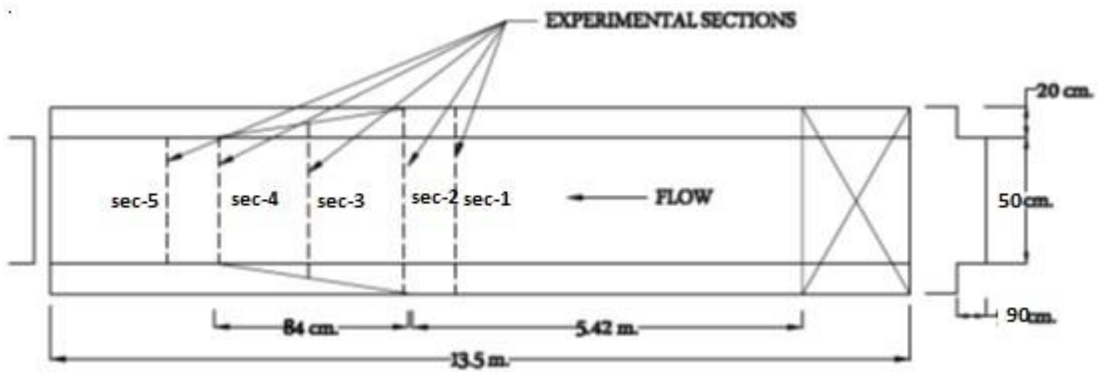


Fig.3.8 Longitudinal & Cross sectional dimension of the compound channel of non-prismatic section (all dimensions are in cm).

3.4.1 MEASUREMENT OF DEPTH AVERAGE VELOCITY

3.4.1 MEASUREMENT OF DEPTH AVERAGE VELOCITY

In the present work speed readings are taken utilizing Pitot tubes. These are set toward stream and afterward permitted to turn along a plane parallel to the informal lodging a moderately greatest he ad contrast showed up in manometers appended to the particular Pitot tubes. The deviation edge be tween the reference pivot and the aggregate speed vector is thought to be sure, when the speed vec tor is coordinated far from the external bank. The aggregate head h perusing by the Pitot tube at t he predefined purposes of the stream matrix in the channel is utilized to quantify the greatness of point speed vector as U = (2gh)1/2, where g is the increasing speed because of gravity. Determinin g U into the tangential and spiral headings, the neighborhood speed parts is acquired. Here the tub e coefficient is taken as unit and the blunder because of turbulence considered insignificant while measuring speed. Point speeds were measured along verticals spread over the fundamental channel and surge plain in order to cover the width of whole cross area. Additionally at a no. of level laye rs in every vertical, point speeds were taken. Especially the point speeds at a profundity of 0.4H (where H is the profundity of stream at that parallel area over the channel) from divert bed in prim ary channel district and 0.4(Hh) on floodplains (h is profundity of fundamental channel) were meas ured all through the horizontal segment of the compound cross segment to tentatively decide the pr ofundity found the middle value of speed dispersion under every release condition. Estimations wer e subsequently taken from left edge purpose of surge plain to the right edge of floodplain includin g the principle channel bed

3.4.2 SOURCE OF DATA AND SELECTION OF HYDRAULIC PARAMETERS

Alongside the in a matter of seconds completed test information set, a broad writing identified with investigation of focalizing compound channels are additionally looked into. The standard informati on set were gathered from a few are set up in Table 1

3.4.2.1 Selection Of Hydraulic, Geometric And Surface Parameters

Stream power through pressure and energy trade in joining compound channels are altogether impa cted by both geometrical and water driven variables, the calculation turn out to be more unpredicta ble when the floodplain width contracted and get to be zero. The stream components in charge of t he estimation of limit shear anxiety and profundity normal speed are Uniting edge meant as θ. ii. Relative stream profundity indicated as Dr. iii. Width proportion (α) i.e .proportion of width of floo dplain to width of principle channel. iv. Angle proportion (σ) i.e. proportion of width of fundament al channel to profundity of primary channel.

Relative separation (Xr) the separation of the point speed in the width shrewd of the cross area/ absolute width of the cross segment mulled over.

Relative profundity (Yr) the separation of point speed profundity savvy of the cross segment/co mplete profundity of the cross area considered.

Relative separation (Zr) i.e of point speed in the length insightful course of the channel)/all out length of the nonprismatic channel. Absolute five stream variables were picked as information para meters and vitality as yield parameter .

3.4.3 ANALYSIS OF ENERGY LOSSES AND INFLUENCING PARAMETERS

The imperviousness to stream of a channel can be altogether expanded by the nearness of constricti ons of floodplain. Different strategies exists for bookkeeping the extra resistance which are for the most part for straightforward directs or winding diverts in term of geometric and stream variables. It has been affirmed that overlooking constriction misfortunes because of joining floodplain can pre sent huge blunder in channel movement estimation.

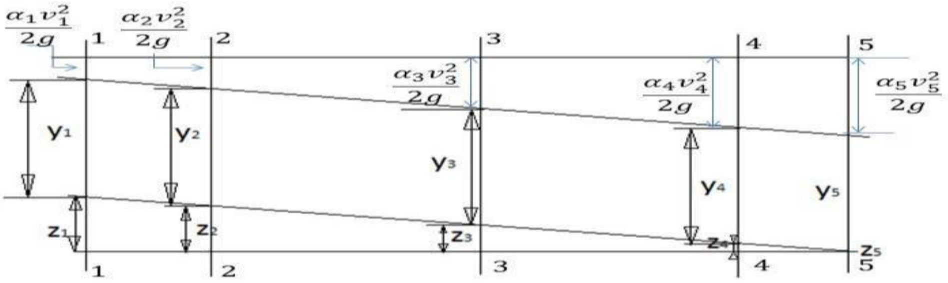


Fig.3.9 Sketch of Energy profile of different section

Consider a channel reach from section 1 to section 2 as shown in Figure1. The total energy head l oss can be calculated from the equation of conservation of energy between sections 1-2.

$$E^1 = z_1 + y_1 + \frac{v_1{}^2 \alpha_1}{2g} \tag{11}$$

$$E^2 = z_2 + y_2 + \frac{v_2{}^2 \alpha_2}{2g} \tag{12}$$

Due to conservation of energy we know that

$$E1 = E2$$

$$z_1 + y_1 + \frac{v_1{}^2 \alpha_1}{2g} = z_2 + y_2 + \frac{v_2{}^2 \alpha_2}{2g} \tag{13}$$

Where z_1&z_2 are the bottom elevation above a given datum at section 1 and 2 respectivel y. y_1 is the flow depth at section 1. y_2 is the flow depth at section 2. $v_1$and v_2 are the me an velocities at section 1 2 respectively. h_1 is the local energy loss due to channel contract ion. $\alpha_1$and α_2 are the velocity head correction factor at section 1 and 2 respectively.

Similarly the value of h_2,h_3,h_4,h_5 are calculated for the section 2-3,3-4,4-5 respectively.

The local energy loss due to the convergence between section 1 and 2 can be expressed as

$$h_1 = E1 - E2 \tag{14}$$

Similarly local energy loss coefficients of different angles of Rezai are calculated .

3.4.3.1 SELECTION OF HYDRAULIC PARAMETERS FOR ENERGY LOSS

Stream water power and energy trade in joining compound channels are essentially impacted by both g eometrical and pressure driven variables , the calculation turn out to be more unpredictable when the fl oodplain width contracted and get to be zero. The stream element in charge of the estimation of vitalit y misfortunes are

i. Meeting point signified as θ ii. Width ratio(α)i.e.ratio of width of floodplain to width of primary cha nnel

iii. Aspect ratio(σ)i.e.ratio of width of primary channel to profundity of fundamental channel

iv. Depth proportion Dr=(H-h)/H. H(height of water at a specific segment),

h(height of water in primary channel)

v.

Relative separation (zr)i.e position of point speed in the length savvy course of the channel)/abs olute length of the nonprismatic channel. Subsequently in this study these five stream variables are pic ked as info parameters and vitality as yield parameter.

3.4.4 SHEAR STRESS MEASUREMENTS

Shear ponders in open channel stream has numerous ramifications, for example, bed load transport, cha nnel relocation, force exchange and so on. Bed shear strengths are helpful for the investigation of bed burden exchange where as divider shear powers introduces a general perspective of channel relocation design. There are a few techniques used to assess quaint little inn shear stress in an open channel. The Prestontube technique is an aberrant appraisal for shear stress estimations and is generally utilized for trial channel which is portrayed underneath. In the accompanying area, results in regards to the appropr iation of limit shear stress alongside the forms of neighborhood shear anxiety is appeared and talked a bout. Additionally the mean limit shear stress results are talked about in points of interest.

3.4.4.1 Methods for estimation of Boundary shear stress

Utilizing Preston's method (1954) together with adjustment bends of Patel's (1965) neighborhood limit s hear stress estimations were made around wetted edge of the present joining channel. Preston built up a straightforward shear stress estimation method for smooth limits in a completely created turbulent str eam utilizing a Pitot tube. In light of the law of the divider supposition (Bradshaw and Huang, 1995), i.e. the speed dissemination close to the divider can be exactly identified with the differential weight b etween the dynamic and static weights, Preston displayed a nondimensional relationship between the dif ferential weights, □P and the limit shear stress,

$$\frac{\Delta p}{\rho}\frac{d^2}{v^2} = F\left[\frac{d^2 tw}{\rho\, v^2}\right]$$

Where, d is the outside diameter of the tube, ρ is the density of the flow, ν is the kinematic visc osity of the fluid and F is an empirical function. Following this work, Patel (1965) presented defi nitive calibration curves for the Preston tube defined in terms of two non-dimensional parameters which are used to convert pressure readings to boundary shear stress:

$$x = \log_{10}\left(\frac{\Delta p\, d^2}{4\rho\, v^2}\right) \qquad (16) \qquad\qquad y = \log_{10}\left(\frac{t_w\, d^2}{4\rho\, v^2}\right) \qquad (17)$$

The calibration of x*and y* for different regions of the velocity distribution (i.e. viscous sub layer, buffer layer and logarithmic layer) is expressed by three different formulae

$$y = 0.5x + 0.037 \qquad \text{for } 0 < y < 1.5 \qquad (18)$$

$$y = 0.8287 - 0.1381x + 0.1437x^2 - 0.0060x^3 \qquad \text{for } 1.5 < y < 3.5 \qquad (19)$$

$$x = y + 2\log_{10}(1.95y + 4.1) \qquad \text{for } 3.5 < y < 5.3 \qquad (20)$$

In the present case, all shear stress measurements are taken at all the five sections of the convergin g angles. The pressure readings were taken using Pitot tube. These are placed at the predefined poi nts of the flow-grid in the channel, facing the flow. The manometers attached to the respective Pitot tubes are use d to measure head difference. The differential pressure was then calculated from the readings on th e vertical manometer:

$$P = \rho g h \qquad (21)$$

Where h is the difference between the two readings from the dynamic and static, g is the accelerat ion due to gravity and ρ is the density of water. Here the tube coefficient is taken as unit and the error due to turbulence considered negligible while measuring velocity.

3.4.4.2 Selection of hydraulic parameters for Boundary Shear Stress

Selection of the currect hudraulic parameter for the Computation of the Boundary Shear Stress gen erated at the walls of the nonprismatic sections throughout the compound channel is essential. The flow factors responsible for the estimation of boundary shear stress and depth average velocity are

i. Converging angle denoted as θ ii.
Width ratio (α) i.e .ratio of width of floodplain to width of main channel iii.
Aspect ratio (σ) i.e. ratio of width of main channel to depth of main channel iv.
Depth ratio (β) = (H-h)/H.
where *H*=height of water at a particular section and, h= height of water in main channel

v. Relative distance (Z_r) i.e of point velocity in the length wise direction of the channel)/total len gth of the non-
prismatic channel. Total five flow variables were chosen as input parameters and energy as output parameter

3.4.5 MEASUREMENT OF BED SLOPE

Measuring the bed incline of the flume, there are a few strategies exists which are utilized by down to earth conditions and analyst's advantage. Here in our present study we quantified the bed incline throu gh water level piezometric tube. So as a matter of first importance we brought the water level with ref erence to the bed of the channel at the upstream side and afterward downstream side of the nonprisma tic channel which is 15m separated. Here the level is taken from the base of the bed barring the Persp ex sheet thickness. In the wake of taking the level at the two focuses, the distinction in the relating le vel was measured. The bed incline of the channel is figured by isolating this with the length of the ch annel. For more precision this strategy was proceeding for three times and the normal was taken as th e bed slant of 0.0011 for 5º meeting compound channel and 0.0017 for 12.38º joining compound chan nel.

CHAPTER 4

RESULTS

4.1 OVERVIEW

In part 3 the exploratory methodology has been depicted with the diagrams are given for the trial tech nique did on the arrangement of the tests. This part will now introduce the consequences of these tests as far as the Depth normal speed disseminations, Energy put away all through the exploratory segmen ts and the vitality misfortune between the trial areas of a nonprismatic compound channe furthermore t he Boundary Shear stress produced in every segment of the nonprismatic comoound channel. The lab e stimations were taken, readings have been recorded for all the segments of the nonprismatic compound channel separately for the greater part of the aforementioned examines considered for this examination work. Subsequent to getting the records and the readings from the test work, investigative work was performed of the information. Customary strategies have been utilized for every single viewpoint, tables have been masterminded and general routine procedures have been utilized to discover the outcomes.

In the wake of discovering the outcomes in the old customary techniques for Depth normal speed, Ene rgy and Energy misfortune computations and the Boundary Shear circulation for the nonprismatic comp ound channel, an Adaptive strategy has been utilized for simplicity of work. Fake Neural Network has been utilized to discover or to foresee the outcomes for the aforementioned parts of stream and it has been seen that less measure of time has been taken and precise results have likewise been found in co ntrast with that of the old ordinary strategies. A correlation has additionally been made between the re al trial information results or in basic words the objective qualities and the anticipated qualities got by ANN strategy and have been looked at. The mistake in figurings have likewise been looked at and ap peared in this exploration work.

4.2 DEPTH AVERAGE VELOCITY RESULTS:

Profundity found the middle value of speed means the normal speed for a profundity "h" is expected t o happen at a tallness of 0.4h from the bed level. Dispersion of stream speed in longitudinal and sidel ong bearing is one of the critical perspectives in open channel streams. It specifically identifies with v arious stream highlights like water profile estimation, shear stress dispersion, optional stream, channel movement and host to other stream elements.

The profundity normal speed estimations have been taken at 5 sequential segments for the two channel s of 5 and 13.38 degrees of the non-prismatic compound directs built in the Hydraulics lab of the National Institute of Technology Rourkel a. Information from the investigations of Bahram Rezai(2006) led on the non-prismatic span of a compound channel has additionally been taken into contemplations. The profundity arrived at the midpoint of speed dissemination inside the crosssegment was measured at three positions for the 2m focalizing case (x=12m, x=13m, and x=14m) and five positions for the 6m narrowing case s (x=8m, x=9.5m, x=llm, x=12.5m, and x=14m) for every relative profundity. In this a player in the st udy, the versatile system of Artificial Neural Network has been utilized to anticipate he Depth normal speed conveyance along the non-prismatic range of a compound channel.

A sum of 19648 information focuses were assembled including the info and target parameters of which 17192 information focuses were the Input parameters and 2456 information focuses were the Output o f the Target focuses or values. 70% of the information and target values have been taken as the Traini ng information set for the present system and the remaining 30 % of the information and target param eters has been taken as the Testing information set for the present Network, which implies that 12035 information focuses from the information parameters have been doled out as the preparation informatio n set and 5157 information focuses have been doled out as the preparation information set for the Inpu t Parameters, likewise 1720 information were alloted as the preparation information set for the objectiv e qualities and the staying 736 information focuses were relegated as the testing information set for the objective qualities.

The investigation was performed in a Pentium 4 processor PC with the Matlab2010 programming

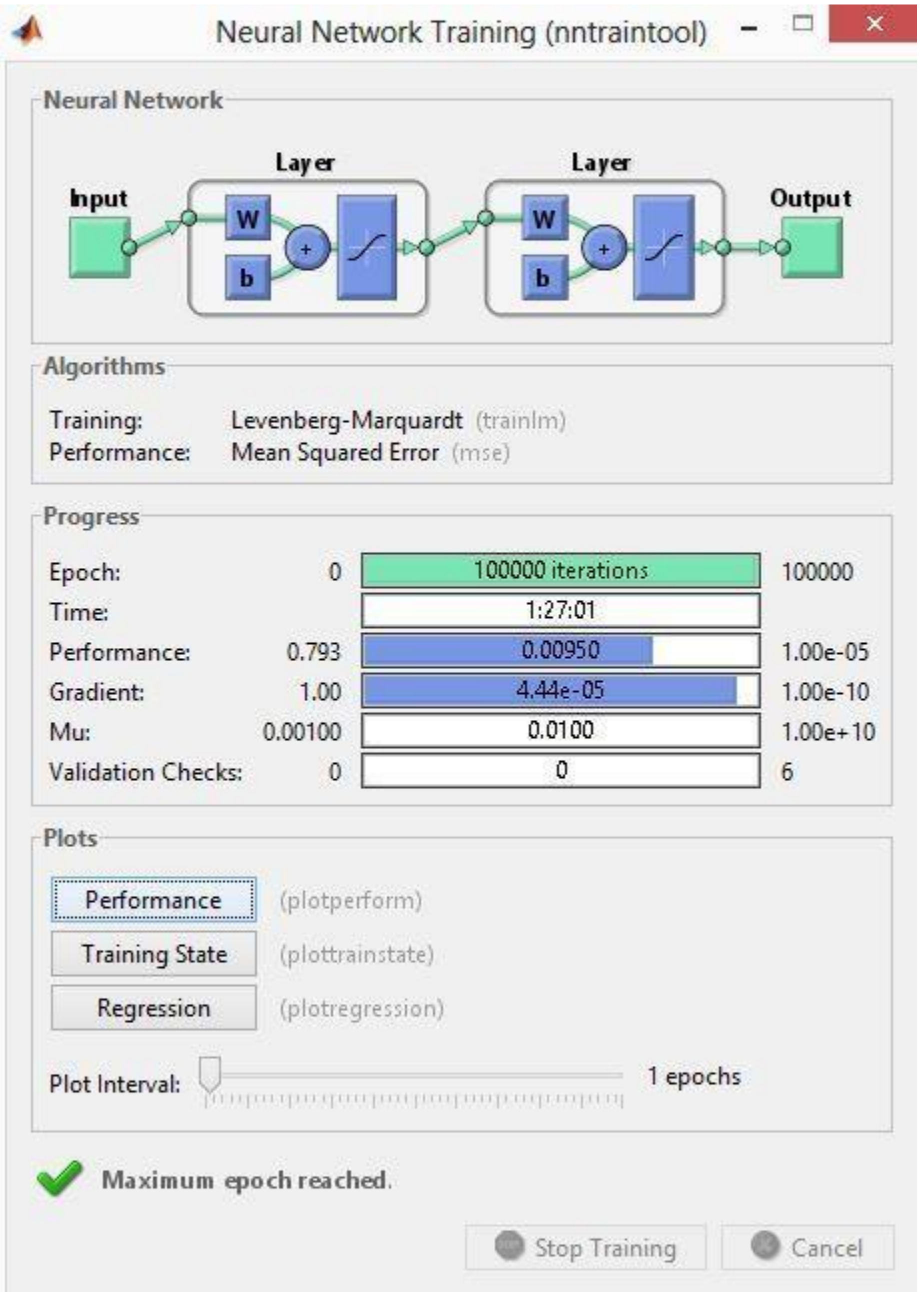


Fig.4.1 Details of the Neural Network tool in Matlab2010

A Regression coefficient of 0.977 has been obtained which shows that the results obtained are quite sa tisfactory as we can see the difference and deflection of the actual target values and the predicted valu es are quite less as is shown in the figure below

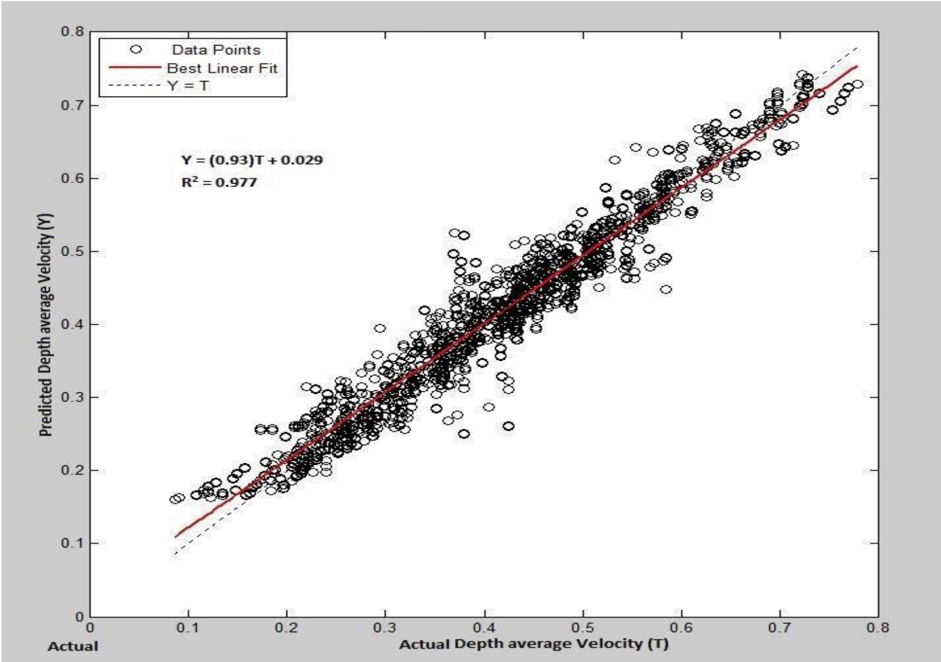
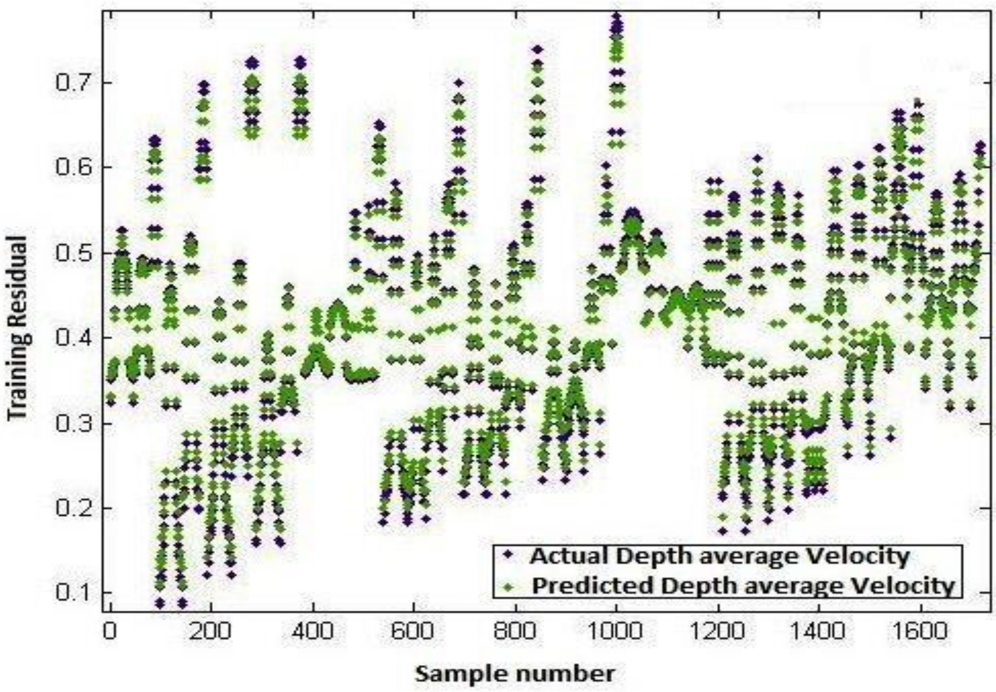


Fig.4.2 Correlation plot of actual depth average velocity and predicted depth average velocity

For better comprehension of the exactness of the outcomes acquired from the Artificial Neural Network and the examination of this versatile system to the traditional ones or the exploratory results we consi der the leftover appropriations of the preparation and testing information sets as are appeared in the fig ures beneath.



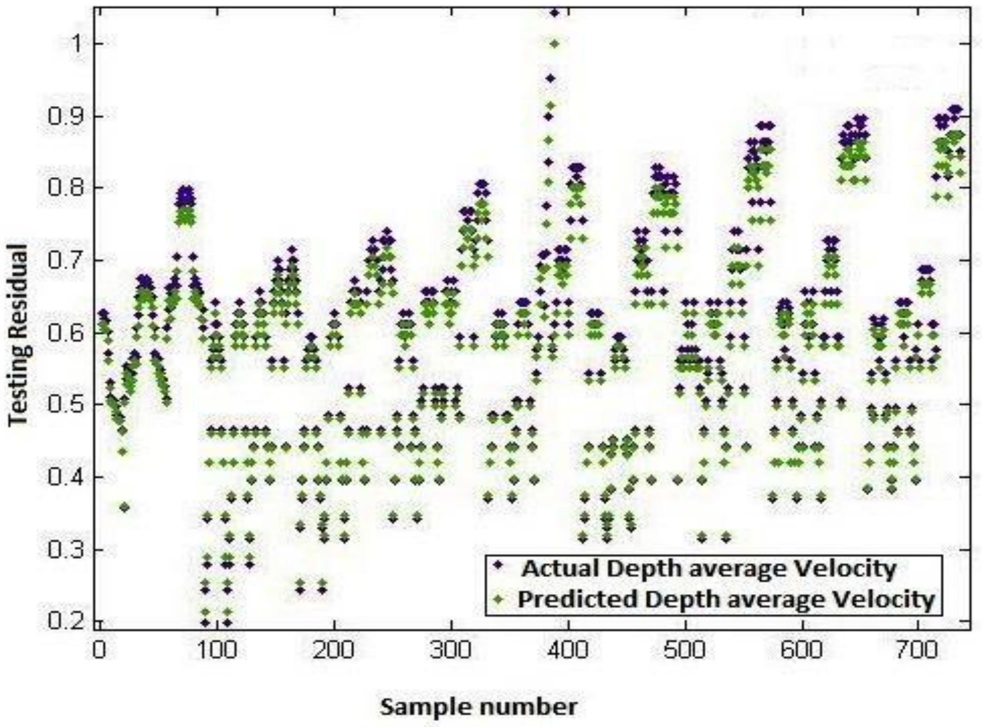


Fig.4.4 Comparison of actual and predicted depth average velocity (testing data)

As the predicted data pattern follows actual data with little or no exception ,it means the models predi ct the pattern of the data distribution with adequate accuracy. Error Calculations have been performed and the effective factors specifically the Mean Squared Error (MSE), the Root Mean Squared Error (R MSE), Mean Absolute Error (MAE), and the Mean Absolute Percentage

Error(MAPE) have been calculated and listed in the table below

Table 4.1 Statistical Results of Emperical Equations in Calculations

Error Calculations	**Depth average velocity**
MSE	0.000255
RMSE	0.015958
MAE	0.012193
MAPE	2.40

4.3 ENERGY AND ENERGY LOSS RESULTS

The aggregate test information set is separated into preparing set and testing set. For E nergy Calculations 679data are utilized among which 476 are preparing information and 203 are taken as testing information. What's more, general the aggregate information s et for Energy misfortune Analysis is taken as 532 information set among which 373 in formation are taken as preparing information and the staying 159 are taken as testing i nformation. The quantity of layers and neurons in the concealed layer are altered throu gh comprehensive experimentation when mean square mistake is minimized for prepari ng information set. It is watched that base mistake is gotten for 61 design. So the bac k spread neural system (BPNN) utilized as a part of this work has three layered food f orward design.

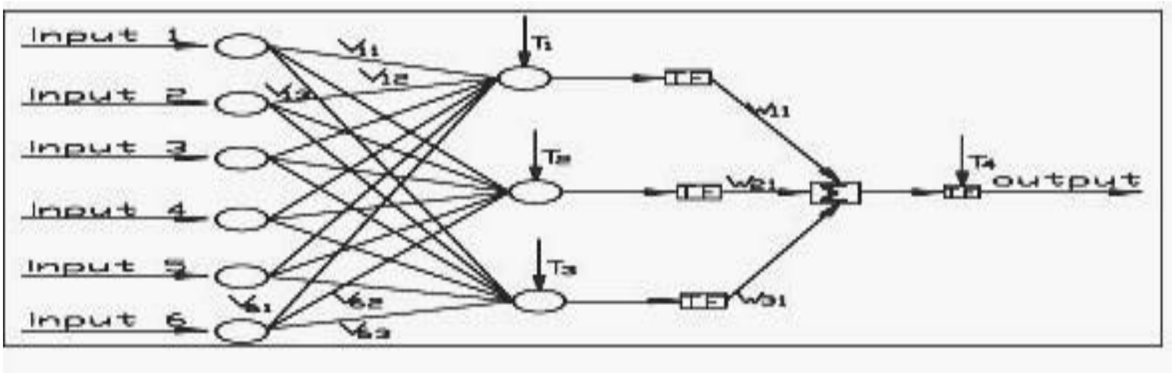


Fig. 4.5 Artificial Neural Network Structure

The model was run on MATLAB commercial software dealing with trial and error pro cedure. A Correlation plot of actual energy and predicted energy stored throughout the experimental sections of the nonprismatic compound channel has been taken into accou nt and also shown as below.

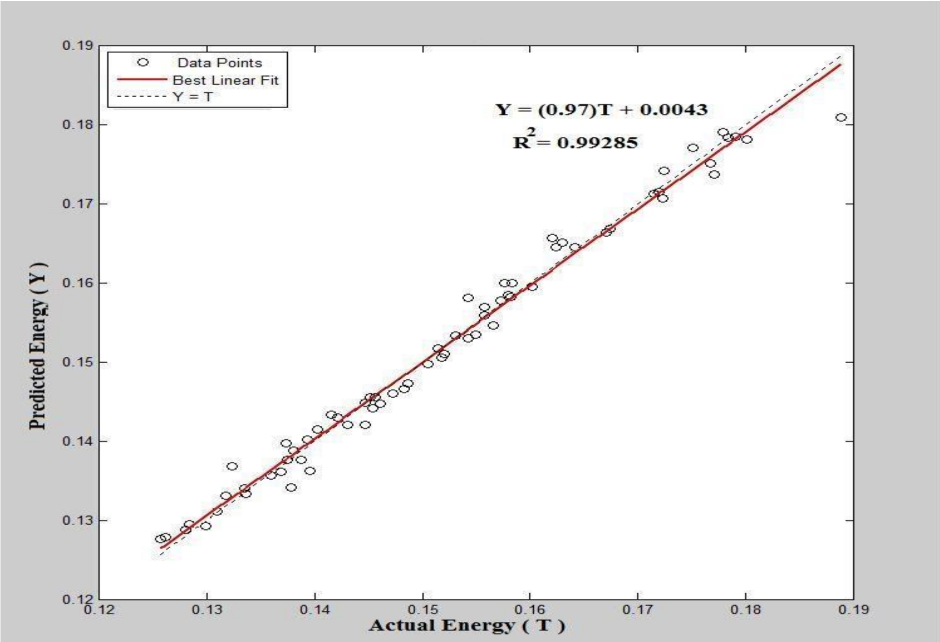


Fig.4.6 Correlation plot of actual energy and predicted energy

In a similar pattern, a correlation plot of actual Energy Loss and predicted Energy Loss throughout the experimental sections of the nonprismatic compound channel has been t aken into account and also shown as below.

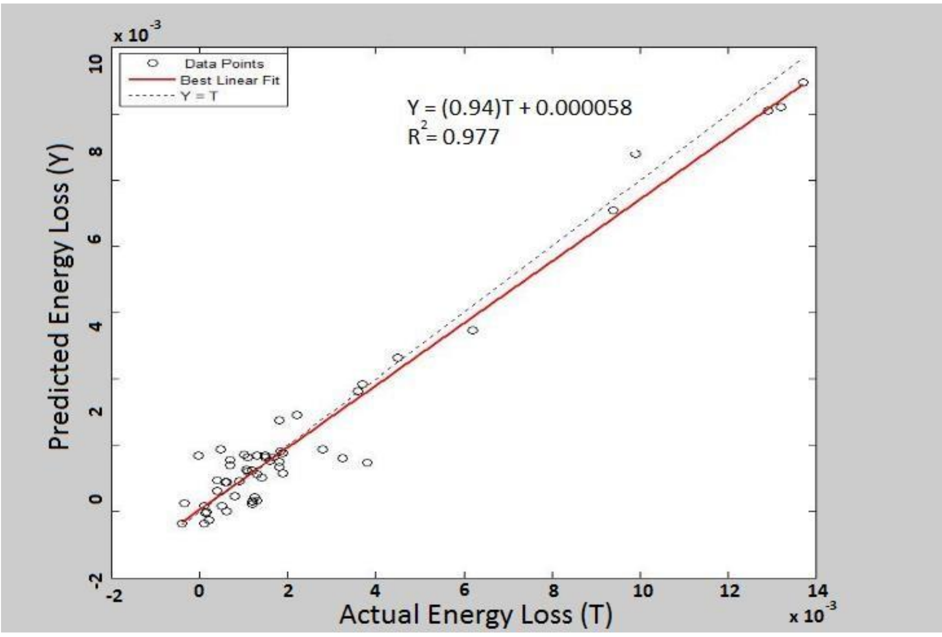


Fig.4.7 Correlation plot of actual energy loss and predicted energy loss

A relapse bend is plotted amongst real and anticipated Energy and Energy Loss inform ation which are appeared in figures above. It can be watched that information for both cases are all around fitted in light of the fact that a high level of coefficient of deter mination R2 of 0.993 is gotten for the Energy Calculations and R2 of 0.977 is gotten for the Energy Loss Analysis between the areas.

The remaining investigation are done by computing the residuals from the real vitality misfortune and anticipated vitality misfortune information. The lingering testing and pre paring information are plotted against the specimen number as appeared in fig (4.8) an d fig (4.9), which demonstrates that the residuals are circulated equitably along the cen terline of the plot. From this it can be said that the information are all around prepare d.

As the anticipated information design takes after real information with next to zero spe cial case ,it implies the models foresee the example of the information appropriation wi th satisfactory exactness

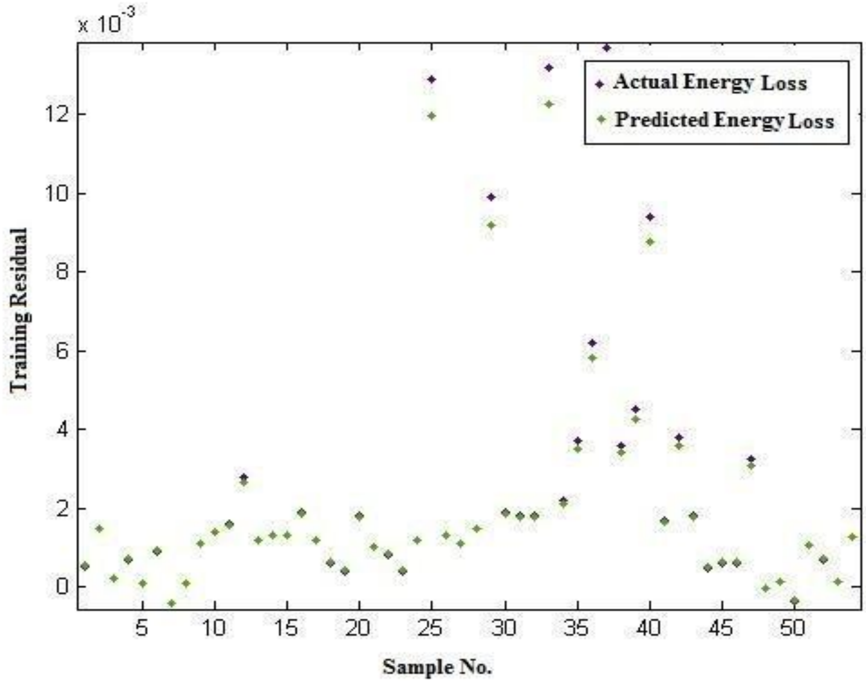


Fig.4.9 Residual distribution of testing data of energy loss

The table below shows the statistical results of the empirical equation in predicting ene rgy and energy loss

Table.4.2 Statistical results of empirical equation in Error Calculations of Energy and E nergy Loss

Error Calculations	**Energy**	**Energy loss**
MSE	0.00000045	0.00000006
RMSE	0.0006673	0.000238211
MAE	0.0004949	0.000107582
MAPE	0.3	4.49

4.4 Boundary Shear Stress Distribution Results

The aggregate exploratory information set is partitioned into preparing set and testing s et. For Boundary Shear Stress Calculations 11998 information are utilized among which 10284 information are taken as the info information and 1714 information are taken as yield information. A sum of 7199 information are taken as the preparation information for info parameters and 3084 information are taken as the testing information for info parameters. Likewise 1120 information are taken as the preparation information set for the yield paramters and the staying 514 information are taken as the testing information set for the yield parameters. The quantity of layers and neurons in the concealed layer are altered through comprehensive experimentation when mean square mistake is mini mized for preparing information set. It is watched that base blunder is gotten for 6-7-1 design. So the back spread neural system (BPNN) utilized as a part of this work has three layered food forward engineering. The model was keep running on MATLAB bu siness programming managing experimentation methodology.

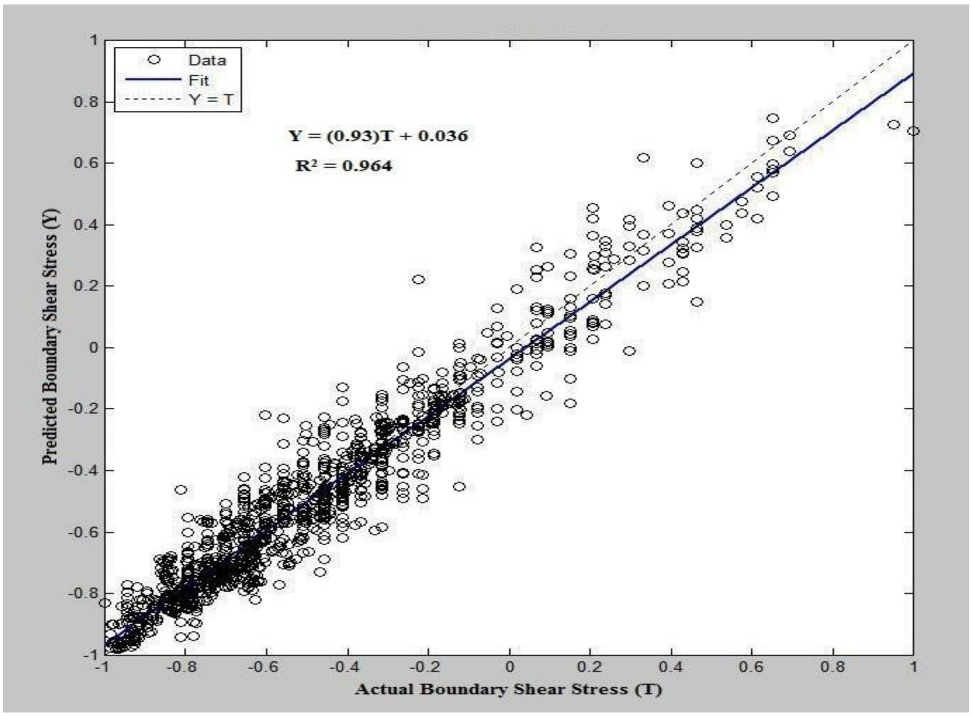
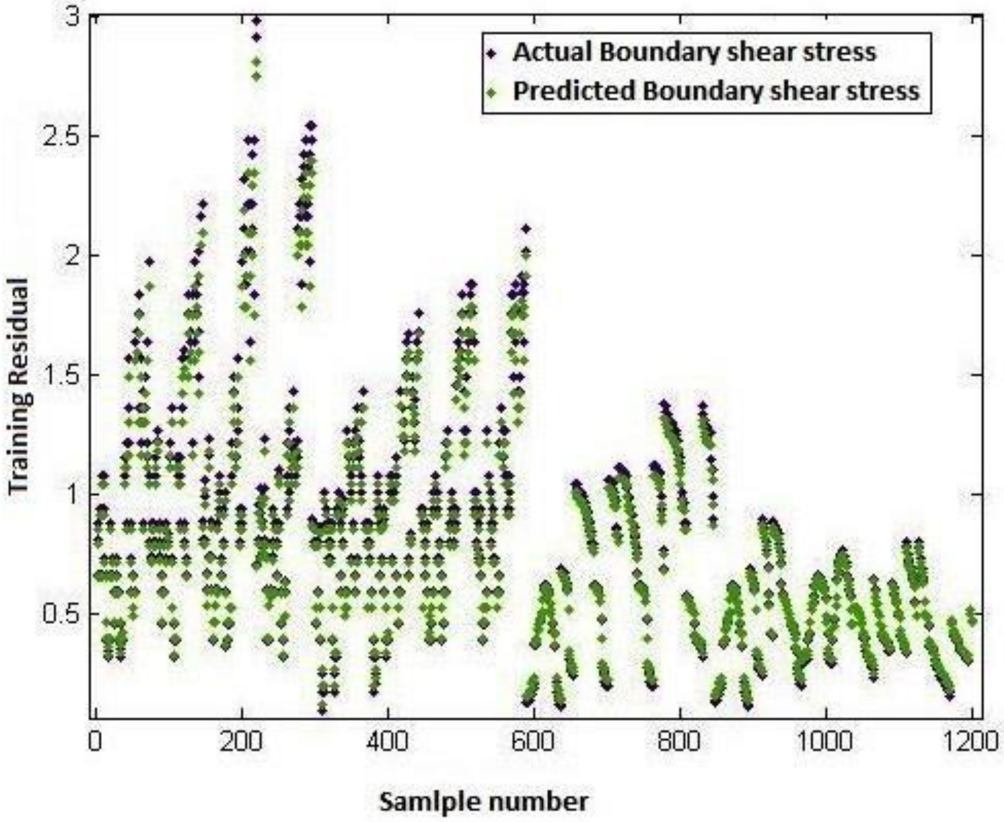


Fig.4.10 Correlation plot of actual boundary shear stress and predicted bounda ry shear stress Residual analysis are carried out throughout the experimental studies and the results are presented below


Actual Boundary shear stress
Predicted Boundary shear stress
Training Residual
Samlple number
0
200
400
600
800
1000
1200
3
2.5
2
1.5
1
0.5

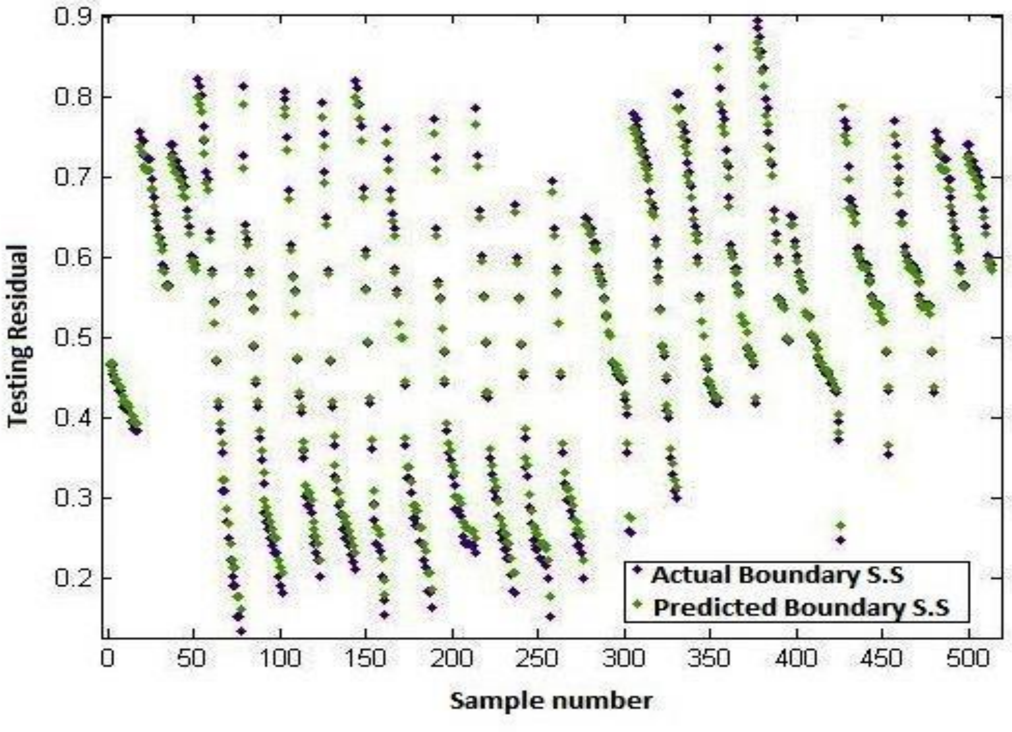

Actual Boundary S.S
Predicted Boundary S.S
Testing Residual
Sample number
0
50
100
150
200
250
300
350
400
450
500
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2

Fig.4.12 Comparison of actual and predicted boundary shear stress(test ing data)

A regression curve is plotted between actual and predicted boundary shear stress whic h are shown in figure (4.9) and (4.10).It can be observed that data for both cases are well fitted because a high degree of coefficient of determination R^2 of 0.964 is obtaine d for the boundary shear stress Calculations. The residual analysis are carried out by ca lculating the residuals from the actual boundary shear stress and predicted boundary she ar stress data. The residual testing and training data are plotted against the sample num ber as shown in fig (4.11) and fig (4.12), which shows that the residuals are distribute d evenly along the centreline of the plot. From this it can be said that the data are wel l trained.

As the predicted data pattern follows actual data with little or no exception ,it means t he models predict the pattern of the data distribution with adequate accuracy. The amo unt of error in the present work has been calculated and analyized and presented as bel ow

Table 4.3 Statistical Results of Empirical Equations in Error Calculations of Boundary Shear Stress

Error Calculations	**Boundary shear stress**
MSE	0.001196
RMSE	0.034577
MAE	0.023199
MAPE	3.33

CHAPTER 5

CONCLUSIONS:

1. Selection of profundity normal speed of focalizing compound channels are found to relies on a quantities of water driven and geometric parameters out of which perspective proportion, profundity proportion, width proportion, relative separation, meeting point and relative profundity are the most affecting parameters.

2. An ANN model is proposed for exact estimation of profundity normal speed of meeting compound channels. The pattern and example of exploratory information matches with anticipated vitality misfortune. The essential reason of high level of forecast exactness lies in the reality of capacity of nonlinear mapping of inputs and yields in a Neural Network framework. The nonlinear connection of geometrical and pressure driven info parameters with and profundity normal speed information are hard to build up with conventional profundity normal speed information expectation philosophy. What's more, the ordinary strategies can't be considered the genuine variables working in the framework. It can be deduced that this model is more versatile to the forecast of limit shear anxiety and profundity normal speed under various conditions.

3. ANN model holds for profundity normal speed MSE as 0.00025, RMSE as0.015958, MAE as

0.012193 and MAPE 2.40. So the present ANN model is additionally persuading model.

4. From the exploratory results on joining compound channels, it is seen that the vitality misfortune between two segments at the gorging is higher than that in later segments. This bit by bit diminishes and achieves least just before the mid of joining area. In the wake of achieving least, there is a progressive build pattern is watched. This might be because of that at the passage area there is an enormous loss of vitality in light of sudden constriction from kaleidoscopic part to non-kaleidoscopic part. After that the stream gets a move lessening the misfortune and it is trusted that the move is finished before mid-segment.

5. In the lower width proportion uniting exploratory channels vitality misfortune is higher at beginning overbank stream profundities then the misfortune diminishes and achieves least toward the end of nonprismatic area. This is on the grounds that the present lower wide floodplain meeting compound channels have a shorter scope when contrasted with other higher width proportion channels.

6. Selection of vitality loss of merging compound channels are found to relies on a quantities of water driven and geometric parameters out of which viewpoint proportion, profundity proportion, width proportion, relative separation, focalizing edge and relative profundity are the most affecting parameters.

7. An ANN model is proposed for precise estimation of vitality loss of uniting compound channels. The pattern and example of test information matches with anticipated vitality misfortune. The fundamental reason of high level of expectation exactness lies in the reality of ability of nonlinear mapping of inputs and yields in a Neural Network framework. The nonlinear connection of geometrical and water driven information parameters with vitality misfortune is hard to set up with customary vitality misfortune expectation technique. Furthermore, the customary methods can't be considered the genuine components working in the system.it can be derived that this model is more versatile to the expectation of vitality misfortune under various conditions.

8. ANN model holds the vitality misfortune forecast with insignificant blunder i.e.MSE as 0.00000006

RMSE as0.000238211 MAE as0.000107582 and MAPE 4.49 which under 10%..

Also for vitality MSE as 0.00000045 RMSE as0.0006673 MAE as 0.0004949 and

MAPE 0.3. So the present ANN model is all the more persuading model.

9. Selection of limit shear anxiety of merging compound channels are found to relies on a quantities of water driven and geometric parameters out of which viewpoint proportion, profundity proportion, width proportion, relative separation, joining point and relative profundity are the most affecting parameters.

10. An ANN model is proposed for precise estimation of limit shear anxiety of merging compound channels. The pattern and example of trial information matches with anticipated vitality misfortune. The essential reason of high level of forecast exactness lies in the reality of capacity of nonlinear mapping of inputs and yields in a Neural Network framework. The nonlinear connection of geometrical and pressure driven info parameters with limit shear stress information are hard to set up with conventional limit shear stress information expectation technique. Also, the customary strategies can't be considered the genuine variables working in the framework. It can be deduced that this model is more versatile to the forecast of limit shear stress under various conditions.

11. ANN model holds the limit shear stress expectation with negligible blunder i.e.MSE as

0.001196 RMSE as0.034577 MAE as0.023199 and MAPE 3.33which under 10%.

The present hypothetical examination bolstered by trial perception is made for Nonpris matic compound channels with floodplains having distinctive stream viewpoint proportio ns. On thevbasis of the examinations concerning the nonprismatic span of a compound channel to discover the Depth normal speed, Energy put away and Energy lost all thro ugh the trial segments and the Boundary shear stress created all through the trial segm ents. stream, the accompanying conclusions are drawn.

Five diverse sorts of straight compound channel designs have been explored TentativelC ompound channels with nonprismatic floodplains, uniting from 400mm to 0mm along 2 m and 6m lengths and narrowing from 400mm to 200 mm along a 6m length.also two of the compound diverts built in the power through pressure research facility of Natio nal Institute of Technology Rourkela with the individual points of 5 and 13.36 degrees. The particular targets of the test research program, have been finished effectively. In t his Chapter the fundamental finishes of this examination are displayed

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